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Swine Producer Appraisal of the Community Assessment Model for Odor Dispersion (CAM)

John C. Tyndall
Iowa State University

Jay D. Harmon
Iowa State University, jharmon@iastate.edu

Steven J. Hoff
Iowa State University, hoffer@iastate.edu

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Abstract

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Keywords

Odor, Swine, Surveys, Producers, Emissions, Extension, Siting

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Comments

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Abstract. *The community assessment model (CAM) for odor dispersion is a tool to assist in the siting of swine production facilities. CAM considers the size and type of a swine production system, local historical weather conditions, and odor control implementation. It predicts the number of hours of exposure to various levels of odor, by month, for each receptor in a given community. A follow-up survey of all CAM users since 2005 was conducted. The survey was designed to provide: 1) formative feedback for programming adjustments to improve Extension efficiency, usability, and reduce costs; and 2) summative feedback used to provide an indirect baseline assessment of the broader impact that CAM has had on reducing odor-related conflict. For the majority of producers who used CAM, the potential impacts to their neighbors factored heavily into decisions. CAM was believed to be very important to the siting process. A high majority (95%) of producers clearly understood the model results. Over half communicated these results to their neighbors where a third of these were considered positive interactions. Overall, for producers who went on to build at sites that were modeled there was a significant improvement in neighbor relations. CAM continues to evolve as a tool, with the addition of more refined odor dispersion parameters and the ability to include cattle and poultry. The state of Iowa has passed legislation that would, when funding is made available, integrate the use of CAM into odor management policy.*

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Reducing the social impact of odor emitted from livestock production facilities has long been a primary management goal for livestock and poultry industries (Honeyman, 1996; Hogberg et al., 2005). Of particular concern is the potential for livestock odor to negatively impact rural and state economies, human health, and the quality of rural life (Korsching et al., 2004; Huang and Miller, 2006). Iowa, the nation's leading hog producing state, serves as an excellent case study as the risk for odor-related nuisance litigation appears to be on the rise (Lee, 2004; Korsching et al., 2004; Heber and Bogan, 2006). Nevertheless, as noted by Otto and Lawrence (2009) the overall importance of the hog industry in Iowa is not in question as an estimated $2.55 billion of personal income and $4.1 billion of gross state product are supported by the hog industry (based on 2007 levels of production).

For all of these reasons, it has been strongly cautioned that for the consideration of economic sustainability, a state like Iowa cannot afford to depress its swine industry by way of legal actions (such as odor nuisance lawsuits), in short, "It's important to the state's economy that (swine) production flourish here, but in a manner that respects the outdoors, health concerns and the quality of life" (Des Moines Register Editorial Board, 2002). To this end it has been said that the sustainability of industries within agriculture will be shaped by their collective ability to improve environmental impact technologies (Kliebenstein, 1998). As this is a risk management issue, it is advisable for producers to be proactive with regard to odor management planning and communication with neighbors (Sharp, 2005). One of the main ways in which producers can be proactive is in determining appropriate sites for new construction or to determine if an existing site can expand. Current siting requirements for new livestock and poultry production systems are based mainly on animal units and distance to the nearest neighbor independent of direction (e.g., Iowa DNR, 2005; Missouri DNR, 2006). Separation distance alone does not account for existing odor sources in a community, nor the influence of localized weather patterns on odor dispersion. A science-based approach requires the use of physics to predict the odor impact on neighboring receptors to develop a procedure for making decisions on where a swine facility of a given size could be placed in a community with or without a pre-existing odor load. In this manner, siting decisions could be made using key odor dispersion variables such as historical weather patterns, size of production facility, odor control measures implemented, and existing odor loads in a community.

Most all models associated with gas dispersion use some form of the Gaussian Plume model (Turner, 1994; Guo et al., 2004). The Gaussian Plume model has persisted over time as a reliable model that predicts reasonably well the dispersion of gases from stationary sources. With appropriate field calibration data comparing odor dispersion from animal sources as a function of atmospheric stability, it is believed that an appropriate tool for siting of animal production

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The authors are **John C. Tyndall,** Assistant Professor, Department of Natural Resource Ecology and Management, Iowa State University, Ames, Iowa; **Jay D. Harmon, ASABE Member Engineer,** Professor, and **Steven J. Hoff, ASABE Member Engineer,** Professor, Department of Agricultural and Biosystems Engineering, Iowa State University Ames, Iowa. **Corresponding author:** Jay D. Harmon, Department of Agricultural and Biosystems Engineering, Iowa State University, 200 Davidson Hall, Ames, IA 50011; phone: 515-294-0554; fax: 515-294-2255; e-mail: jharmon@iastate.edu.

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systems can be developed and more importantly, used in practice. The objective of an odor dispersion model of this type is to describe the historical average conditions that receptors in a community of animal production systems might experience and not on an hour-by-hour, day-by-day, etc. basis. Instead, historical average conditions, along with parameters that reasonably describe odor sources, are implemented in an attempt to provide a siting tool that predicts historical average expectations.

Hoff et al. (2008) developed the community assessment model for odor dispersion (CAM) in which parameters were used to predict odor strength levels downwind from multiple sources to multiple receptors. CAM can currently model up to 20 swine-related sources and up to 100 receptors in a land base of any size. The model is intended as a tool to help site new facilities and to evaluate the effectiveness of odor control technologies for both new and existing facilities. CAM considers the overall size of a swine production system, the type of swine production system (production phase), local historical weather conditions, and odor control mitigation strategies which have been implemented. It predicts the number of hours of exposure to various levels of odor, by month, for each receptor in a given community. This final distinction is very important. CAM can be classified as a receptor-based model versus a source-based model. CAM views odor dispersion from a receptors point-of-view, determining the odor impact on each receptor from all sources in the community, a newly proposed source as well as from all existing sources. This is in stark contrast to a source-based model where in general circles of odor influence around the source are predicted, with no direct link to each and every receptor in the community.

To date, CAM has been used in the state of Iowa for over 150 specific cases since June, 2005. The implementation of CAM has been a voluntary process, initiated by the farmer and implemented through a joint effort between the Coalition to Support Iowa's Farmers (CSIF), the Iowa Pork Industry Center (IPIC), and faculty with Iowa State University's College of Agriculture and Life Sciences. The estimated total expense (currently free to the farmer) to implement CAM is $1,000 per siting case; this cost includes faculty and staff time, travel expenses, materials, and computer time.

Because the modeling process is costly and the information being assessed and conveyed to producers is complex, it is important for programming of this type to continually seek ways to improve efficiency and clarity of process (Petheram, 1998). In order for the information encompassed within the modeling process to be used effectively in guiding pork producer decisions, producers need to fully understand what the model is doing and ultimately predicting. As with all extension programming, it is critical that program evaluation involve the systematic collection of key stakeholder information for the purpose of making decisions regarding program effectiveness (Douglah, 1998; Anderson and Feder, 200). As noted in Carberry et al. (2002), while science is judged traditionally in terms of tests of accuracy and precision, as science is applied, usefulness becomes the primary test and evaluation is critical to the notion of science based program accountability. Therefore in order to gather formative, process oriented evaluator feedback as well as have a better summative understanding of the broader impact of the model on farmer decision making, we conducted a follow-up survey of past CAM users in 2008.

Objectives

The objective of the survey was to provide information for two different evaluative perspectives: 1) direct process feedback that will be used to make adjustments in order to improve educational programming efficiency, usability and reduce costs, and 2) summative feedback that will be used to provide an indirect baseline assessment of the broader impact that CAM has had on reducing odor related conflict.

Survey Tool and Information Sections

The survey tool was designed to elicit evaluatory information regarding several key areas of the modeling and extension process and to provide background information on the producers/production systems who sought siting assistance. Specifically, questions covered: 1) overall producer impressions regarding the modeling and extension process, 2) the understandability of the model and model results, 3) producer impressions on the ability of the model to predict odor exposure, 4) overall effect of model process and results on producer decision making, 5) characterization of neighbor and community relations before and after the modeling process, and finally 6) details about the producers themselves.

In total, 85 producers who utilized CAM since 2005 were targeted for interviews. These producers were identified as having sufficient time since the modeling to have reasonable insights into the process and drawn conclusions regarding post-modeling outcomes. The survey was conducted via telephone interviews and followed Dillman et al. (2008) tailored design telephone survey protocols. Data was collected by the Center for Survey Statistics and Methodology (Iowa State University) in the Fall of 2008. Ten of the producers were re-classified as ineligible (e.g., in six cases the modeling had been done too recently to provide significant insights; three producers did not recall participating). This resulted in an eligible sample of 75. Interviews were completed with contact people for 62 of the facilities, for a response rate of 82.7%.

Description of the CAM Process

Currently, there are quite a few outlets that feature information regarding CAM and related Extension (farmer education) programming. In terms of learning about the model and modeling process, for 81% of the participants the Coalition to Support Iowa's Farmers (CSIF), a not-for-profit (501 c 6) organization (and programming partner), has been the main source of information. Iowa State University Extension via multiple nodes (e.g., personal communication, workshops, and conferences) was the second source of information regarding CAM with 29%. The Iowa Pork Producers Association (IPPA) and the Iowa Pork Industry Center (IPIC) were mentioned by about a fourth of the respondents. The other responses to this question (e.g. other producers, pig suppliers/integrators, Farm Bureau, attorney) indicate a degree of "word-of-mouth" exposure. Table 1 below summarizes the most used sources of CAM information.

Table 1. Top sources of information where producers learned about the CAM model process (n = 62).[a]

Source of Information	Producers (%)
The Coalition to Support Iowa's Farmers (CSIF)	81
Iowa State University Extension (e.g., personnel, workshops, conferences)	29
Iowa Pork Producers Association (IPPA)	25
Iowa Pork Industry Center (IPIC)	22
Someplace else[b]	16
Another producer	15
A pig supplier or integrator	13

[a] Note that producers were able to list more than one source.
[b] Farm Bureau (8%), attorney (5%), "Our feed guy" and Corn Growers Association (3% combined).

The modeling process begins when a producer contacts personnel associated with the CSIF and formally requests that a model be conducted for a proposed site. The use of CAM requires an on-site visit to assess and map community receptors and existing animal-related odor sources. The mapped data is then brought to the Department of Agricultural and Biosystems Engineering (ISU) where one of two faculty members executes the CAM. At the conclusion of a CAM modeling run, a staff member from IPIC conducts a follow-up site visit with the farmer to present and explain a one-page report regarding the CAM predictions.

From the producer's perspective, timeliness is a critical part of the modeling process as producers are making capital intensive decisions that may be time-sensitive with regard to obtaining financing, making land bids, and pursuing appropriate permits. A high majority of respondents (82%) felt as though the time between their request for modeling and the delivery of the report was acceptable. Overwhelmingly, 98% of the producers felt as though they were given significant opportunity to provide input into the modeling process. Key producer input includes the accurate description and identification of the potential site(s), the anticipated scale and type of operation, and the thought process and determining factors the producer used to decide on a potential site; this information being highly critical to modeling a location accurately.

Of significant importance to the future of CAM programming is current operating cost. While currently free to the producer due to support from partnering organizations, CAM is a labor-intensive procedure and therefore costly ($\approx$\$1,000 per producer request; includes faculty and staff labor, travel, and computer time) and yet involves considerable direct input from the producers. Therefore it is critical to determine ways in which the producer can further assist with the process, making it more efficient and reducing overall costs. Forty-two percent of the respondents felt that there were portions of the modeling development that they could have done on their own. Twenty-four percent of producers felt capable of mapping planned site(s) (using downloadable orthophotos, platt maps, and/or manure management plan documents) and documenting separation distances between proposed site and neighboring homes, business, and wells. Another task mentioned (by 8% of the producers) was the prior logging of critical numbers (e.g. planned number of animals, building orientation, building/ventilation type, etc.) perhaps via a standardized on-line template. This information will help guide future protocols to facilitate greater producer involvement.

Seventy-seven percent of the producers stated that a web site showing examples of model results would be useful to them. Web-based data entry was also mentioned to be a useful way for producers to submit information templates directly and thereby reduce analysis time. This was particularly true for swine production companies with multiple modeling requests. Additional to the internet providing an opportunity for better upfront data exchange, responses to the open-ended question "From your perspective, how could the process of executing the model be improved?", two of the main response themes involved the ability to view the results of their model online and the availability of electronic displays (examples) of well labeled/explained data. There were also a few producers who indicated that they wanted more site visit opportunities to discuss results and provide guidance based on model results. This is something that a web-based interface might discourage. Just under half (48%) of the respondents felt that the current process for executing the model from initial contact to receiving final results served their needs well.

Producers's Understanding of the Model

Because of the inherent complexity of the model itself (e.g., the computational rigor, the number of factors being assessed, and interpretation of results) conveying these complexities succinctly and accurately is critical to the producer education process. Informed decisions hinge on the transparency of the process and the understandability of the results. Understanding model parameters and interpretation of results make swine producers more effective in assessing the risks of siting production facilities. This also can lead to greater educational program efficiency with fewer steps and fewer errors. Producers that understand the process well should be able to explain results to neighbors effectively. Overall, the vast majority (92%) of the producers felt that the CAM results were explained to them "well" to "very well" (42% to 50%, respectively). In turn the information process translated similarly into general model understanding with 95% stating that they understand the model results "well" to "very well" (50% to 45%, respectively).

The two main parameters of CAM that are critical for producers to understand are the number of hours of odor exposure and odor dilution levels. As explained in Johnson (2006), the modeling is conducted for odor exposure during a March to October (8 month) time frame to correspond to the period of time when residents tend to spend the most time outdoors. The modeling procedure assesses a given site based on the percent time exposure of a residence to various levels of odor. CAM predicts the number of hours of exposure for weak (2:1 dilution factor) and stronger, or identifiable (7:1) and stronger odors. An odor concentration of 2:1, for example, means it would take two volumes of fresh-air mixed with one volume of odorous air to make the odor "barely detectable." Additionally a few states (e.g., Colorado, Wyoming, and Missouri) use an odor concentration of 7:1 to assess whether an operation is in compliance relative to odor (Powers, 2003; Johnson, 2006). Currently, site selections are judged based on a limit of a 1% time exposure to a 2-to-1 (2:1 and stronger) odor and a 0.5% time exposure to a stronger 7:1 and stronger odor. Eighty-six percent of the interviewed CAM users stated that they understand the concept of hours of exposure well to very well (42% to 44%, respectively). A

Table 2. Degree to which participating producers understand the results of the Community Assessment Model.

Understanding the CAM model	Not Well at All	Not Well	Moderately Well	Well	Very Well
Overall, how well was the CAM model results explained to you?	--	2%	6%	42%	50%
How well did you understand the CAM model results overall?	--	2%	3%	50%	45%
How well do you understand the concept of hours of exposure	3%	3%	8%	42%	44%
How well do you understand the concept of odor dilution levels?	3%	8%	32%	32%	24%
How well could you explain the model results to others?	--	4%	36%	45%	15%

lower, but still majority percentage of producers (56%) understand the concept of odor dilution factors well to very well (32% to 24%); just under a third (32%) stated they understand dilution moderately well. These levels of understanding are important when producers explain the results of CAM to neighbors. Sixty percent believe that they understand the model well enough to explain the results to others; 36% could explain the results moderately well. Communication with neighbors is consistently listed as a key to preventing or mediating conflict (Caldwell and Williams, 2003). Being able to convey technical information using the terms of the model was noted by many of the CAM using producers as being an important component in maintaining their community relationships (see the Neighbor Relations section below). Table 2 below summarizes how well these CAM users understand the model.

An open-ended follow up question asked the producers "What would help you to understand the results better." The top requests indicated producers wanted a more thorough explanation of results that would include periodic Extension advisor follow-up. There were also some requests for "cheat sheets" in the form of official documents/materials that could be used for explaining the modeling process to neighbors.

Influence of the Model on Producer Behavior

Sixty-eight percent of the respondents opted to build the sites that were modeled with CAM; 32% were not built. Overall, just under half (48%) of the respondents stated that the model results directly affected their decision on whether to build or not. Fifty percent of the producers who opted not to build indicated that the model contributed directly to their decision. For the other half that did not build for reasons other than the model results, 15% opted out strictly for financial reasons (due mostly to a mix of low hog prices and high feed costs); another 10% did not build largely due to pre-existing social pressures regarding odor though the model results did confirm their original concerns. Of the 68% of producers who did build, 26% said they built largely because it was located close enough to their cropping operations that they could utilize the manure (or that they had manure buyers in mind), though the model did confirm their original opinions that the location was a good one.

According to 74% of the producers, the model verified what they already suspected regarding the viability of the site being modeled. Based on the subjective assessment of the producers who did build, 36% feel as though the model predicted what actually happened in terms of odor exposure "very well" and 31% said it predicted "well". Another 14% said that the model has predicted "moderately well" and 14% stated that it is still too early to tell. Only 5% think that the model's predictions ended up being incorrect (underestimating the impact they would have on neighbors).

Just under half of the participating producers (47%) indicated that they were surprised by some of the results. Based on 29 responses to an open ended probe question the top surprises were: 1) that the model predicted less of an impact than expected (this from 13 producers), 2) the prevailing wind direction turned out to be in a different direction than previously believed (9 comments to this effect), and one producer expressed surprise in just how far odor can travel. Only one producer said that he was surprised the model predicted a greater than anticipated impact on neighbors.

Neighbor Relations

A high majority of the producers who had sites modeled by CAM (81%) stated that their overall concerns regarding the potential impacts to their neighbors factored heavily into the decision to build or not. Almost half of the sites assessed with CAM were located less than one-half mile from the nearest non-relative neighbor, another 48% were located within one-half and one mile.

Fifty-eight percent of the producers who used the CAM subsequently communicated the modeling process and results of the model to neighbors (40% did not; 2% of the corporate producers were not sure). A third of the time, neighbors responded to the modeling results positively to very positively (25% and 8%, respectively). Almost another third (31%) of the neighbors reportedly reacted in a neutral way and another 30% reacted poorly to very poorly (22% to 8%, respectively).

Producers were asked to rate (on a 5-point scale; 1 = very poor, 5 = excellent) their relationship with proximal neighbors at the time of modeling and, if construction took place at that location, afterwards. The overall mean score at the time of modeling was a 3.39 meaning that by and large the relationships were moderate leaning toward being "good." Breaking this down, 56% of the producers said that at the time of modeling their relationships with proximal neighbors were good to excellent (33% to 23%, respectively). Twenty-three percent stated that their neighbor relations at that time were poor to very poor (15% to 8%, respectively). After the modeling, 40 producers went on to build at the modeled site. After construction, the overall mean score shifted distinctly to the "good" category with a statistically significant mean score change to 3.60 ($F = 13.591$; $p = .0001$). Eight of the producers moved into improved relations with their neighbors after modeling (five moving from poor to moderate or good, two moving from moderate to good and one moving from good to excellent). Three of the producers, however, saw their relations become worse with one of them experiencing an excellent relationship becoming very poor after constructing the facility. Table 3 below summarizes this data. For those producers whose neighbor relations improved, the producers were asked what they saw as the factors that led to the change. For those producers whose relations improved the leading factor was that "things (e.g.

Table 3. Producer ratings of neighbor relations during time of modeling and after construction.[a]

Timing	Total n	Mean Score[a]	Producer Rating of Neighbor Relations				
			Very Poor	Poor	Moderate	Good	Excellent
During modeling	62	3.39	8%	15%	23%	33%	23%
After construction	40	3.60[b]	8%	5%	28%	40%	20%

[a] On a scale from 1 to 5, where 1 means very poor relationship and 5 means an excellent relationship.
[b] Significantly different, F = 13.591; p = 0.0001).

odor, noise, flies) didn't turn out to be as bad as they (the neighbors) originally assumed they would."

Overall, 75% of the producers rate the usefulness of the modeling process and results as useful to very useful (23% to 52%, respectively); 15% viewed the CAM process as moderately useful. Ten percent indicated that the CAM process was not particularly useful; however, this conclusion appears to be an artifact of the situation that most of these producers likely would not have built regardless of the model results as they opted not to build for financial reasons

In response to a final open-ended question asking producers for suggestions about how individual pork producers can effectively deal with neighbor or community concerns regarding their production facilities, 46% of the CAM users stated that direct and personal communication ("face to face") with neighbors is absolutely key. To that end, it was mentioned repeatedly that scientific information (such as that provided by CAM) from a place like Iowa State University distinctly can help convey objective perspectives on potential odor issues. Some producers suggested that site modeling should be mandatory. Many producers additionally added that "open-houses," "complimentary pork gifts," and gifting manure also can go a long way to strengthening neighbor relations. Finally it was mentioned by 16% of the producers that working with organizations like CSIF is definitely a plus, partly because these organizations can get producers in touch with programming such as CAM but also because they are skilled at mediating difficult situations.

Producer Demographics and Characterization of the Facilities Modeled

The average age of the producers who utilized CAM was 45. In terms of ownership structure, half of the producers who used CAM were contract growers, 26% were owner-producers, 10% raised both their own hogs as well as others on contract, and 8% were corporations. Forty percent of the CAM users generally have between 1,000 and 5,000 head of pigs in their total operation, 36% have over 10,000 pigs at any one time. Since 2005, just under three-fourths (74%) of the producers utilizing CAM had only one site modeled, 18% had two options modeled and 5% and 3% had three to four different sites modeled, respectively.

A diversity of facility types and planned production scales were modeled by CAM. The majority (69%) of the planned production sites modeled were for 1,000 to 2,500 head finishing or wean-to-finish facilities. Forty-five percent of the buildings were tunnel ventilated with another 36% being side-wall curtain systems with cold-weather mechanical ventilation, the rest (19%) were designed to be 100% natural ventilation systems. The vast majority (95%) of the modeled facilities included a deep-pit manure storage system. Table 4 displays these general production details.

Table 4. Characterization of modeled facilities and general production details.

Characterization of the Facilities Planned	Producers (%)
Number of potential building sites modeled per producer	
One site	74
Two sites	18
Three sites	5
Four sites	3
Production type	
Wean to finish	73
Grow/feeder to finish	26
Production scales modeled	
< 1,000 head	7
1,000-2,500 head	69
2,501-5,000 head	14
5,000 head +	9
Ventilation systems	
Tunnel ventilated	45
Hybrid-curtain walled	36
100% natural	19
Manure storage	95
Deep pit	5
Compost	2
Above ground (concrete or steel)	2
Lagoon	0

Future Development

As Hoff et al. (2008) noted in the technical description of CAM, the percentages of exposure in the CAM approach do not include calm meteorological conditions which would have an effect on decision percentages at each odor category. Therefore, part of the current research agenda for CAM is the integration of calm meteorological conditions (e.g., wind speeds ≤1.03 m/s) as well as other key odor dispersion factors such as terrain variations and obstruction downwash. Additionally, swine is the only species for which CAM is calibrated. As such, CAM will be extended to other pertinent species which will require inclusion of source volumetric rate, odor concentration data, and seasonal variation (Hoff et al., 2008).

In addition to these technical enhancements to CAM, an examination of the social effectiveness of CAM is currently underway. Because CAM examines physical odor dispersion from a receptor's point-of-view, it is highly instructive to assess the opinions of potential receptors regarding both odor nuisance and modeling (Irvin and Stansbury, 2004). In order to have a better understanding of how receptors define the concept of "nuisance odor" (at their home) and to better socially gauge the physical parameters of CAM, a public survey is being designed to determine how much odor the public is willing to tolerate and how willing the public is to accept modeling and modeling results in locating hog production sites. The survey will also examine various social factors that likely mediate degrees of acceptance regarding odor and the modeling of odor. These factors include: demographic details (e.g., age, income, education, gender), experience with farming, experience with odor, concerns regarding environmental issues, and opinions regarding the pork industry (Mikesell et al., 2001). Enhancements to the Extension educational approach will be incorporated based on this survey.

Finally, in spring 2008, Iowa House File 2688 (Livestock Applied Research and Evaluation) was signed by Iowa Governor Culver. This Bill authorized a three-phase, multi-institute (ISU, Iowa Department of Natural Resources, and the Iowa Department of Agriculture and Land Stewardship) interactive approach for siting swine production facilities for producers who seek advanced evaluatory assistance. Phase one involves an internet-based self assessment, followed by a phase two consultation with a specialist designated by ISU. If recommended by the specialist designate, phase three will involve the modeling of the site using CAM. This bill remains unfunded; however, HF 2688 is a policy bill, which will provide the framework for future appropriations (IPPA, 2008).

Conclusions

A diversity of pork producers with various production systems utilized CAM in order to make better decisions regarding the siting of production facilities. Based on the findings of the producer survey, the current programming appears to be largely effective in terms of understandability and process (from initial producer request through to the presentation of results). However there were suggestions that can be used to help improve programming for pre-modeling and post-modeling phases. Some questions revealed potential improvements to facilitate a higher level of producer participation via increased pre-model interface opportunities to provide key model input, thereby streamlining the modeling process. A web-based information hub with data-entry capacity (specifically for the producer to provide model parameters) would likely improve the model initiation proceedings. The information conveyed to the producers is complex and their understanding of the model results are critical on two fronts: 1) using the CAM results to help make well informed decisions that critically weigh site location risk; and 2) in being able to effectively communicate the results to concerned neighbors. Approximately 40% of CAM users expressed a moderate ability to explain the model and some of its key parameters to neighbors, therefore improvements in data presentation and explanation (perhaps utilizing more user-friendly graphics and more lay-audience language) will be sought by program developers.

In terms of gauging the impact effectiveness of CAM, at this point the only information gathered is from the producers' point-of-view. The model played a significant role in the siting decision process of many producers. In some cases the model confirmed producers' initial beliefs about a site but for many producers CAM also revealed "surprises" in how odor moves and interacts with wind patterns. It is believed by a number of producers that CAM was a very useful tool in terms of communicating the complicated issues of environmental risk to neighbors. Sixty-seven percent of the CAM users believe that all evidence (from their point of view) suggests that CAM "got it right" (14% believe that it was moderately close). Overall, for those producers who went on to build at sites that were modeled there was a significant improvement in neighbor relations. While it is not possible to determine to what degree CAM played in this improvement, it is suggestive after examining across all the previously summarized data that CAM was a major contributor

As CAM continues to evolve as a tool, it will be important for support programming and producer interaction protocols to similarly develop. Formative and summative feedback from the users of complex decision support tools such as CAM is, and will continue to be, an integral part of the CAM process.

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